PART 18

ENVIRONMENTAL MANAGEMENT PLAN (EMP)

AND

ENVIRONMENTAL MONITORING PLAN (EMoP)

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18. General

Mitigation measures and monitoring for Environmental and Social considerations shall be carried out by the Contactor during the Construction and Operation Service Phases in accordance with the Environmental Management Plan (EMP) and the Environmental Monitoring Plan (EMoP). The results of monitoring will be provided to BWSSB on a quarterly basis during the Construction Phase and biannually during the Operation Service Phase till the end of the Project. In case the results of monitoring contravene Indian and/or International Standards and/or tender requirements and/or significant adverse impact(s) is/are identified, necessary measures shall be taken by the Contractor with no additional cost.

18.1 Proposed Environmental Management Plan (EMP)

The Contractor shall carryout mitigation measures based on the proposed Environmental Management Plan (EMP) including indemnification as indicated below.

18.2.1 Construction Phase - EMP

S. No	Impacts	Proposed Mitigation Measures	Actor for Mitigation Measures	Regulatory Authority
1	Social Infrastructure / Service	• Prior notice to traffic police before the construction works. • Placement of traffic guides at each end of construction sections for smooth inducement of traffic. • Careful examination of Contractor's construction plan and schedule. • Setting detouring route if necessary. • Sufficient information disclosure such as construction period or work section to media such as television, radio, newspapers, etc. as well as utilization of internet media. • Socialization activity to local residents including distribution of leaflet or announcement letters or holding meetings if required. • Implementation of underground utility survey for existing water pipes, power lines, telephone lines and gas pipes not to cause damage on these utilities. • Adoption of trenchless method at crossing points of roads with heavy traffic and railway crossings.	Contractor	Police/ BWSSB/ Consultant
2	Infectious	• Preparation of appropriate working health	Contractor	NACO/

S. No	Impacts	Proposed Mitigation Measures	Actor for Mitigation Measures	Regulatory Authority
	Diseases	plan. • Training of working health for workers. • Biannual health camps for workers		KSAPS/ BWSSB/ Consultant
3	Occupational Health and Safety including communication plan	• Preparation of construction plan. • Training of construction workers. • Formulation of procedure to work in confined space. • Preparation of emergency safety plan. • Provide construction workers with sufficient personal. • Provide safety action items for fall / trips / electrical shocks / highest / scaffolding etc., • Protective equipment such as hard hats, earpiece, safety shoes, goggles, and others. • Emergency safety equipments such as Breathing apparatus, reviving apparatus, Vessels containing oxygen or air, Safety harness & ropes and Audio alarms for alerting workers at construction site. • Conduct explanation meetings on safety issues for local communities. • Install warning signs whereas the potential dangers are expected. • Erect temporary fence around high-risk areas to control public access and light them at night if that is on the regular roads used by the locals. • Assign construction staffs on or near places where construction vehicles are crowded to ensure safety.	Contractor	KPCB/ BWSSB/ Consultant
4	Air Pollution	• Preparation of construction plan for control dust and particulate matter. • Examination of Contractor's construction plan especially on dust control and particulate matter. • Monitoring of Contractor's dust and particulate matter control.	Contractor	KPCB/ BWSSB/ Consultant
5	Waste	• Preparation of construction plan for excavated soil and demolition waste.	Contractor	KPCB/ BWSSB/

S. No	Impacts	Proposed Mitigation Measures	Actor for Mitigation Measures	Regulatory Authority
		• Examination of Contractor's construction plan. • Monitoring of Contractor's management of excavated soil, construction debris.		Consultant
6	Noise / Vibration	• Utilization of low-noise type construction machineries. • Temporary enclosure of the site during the construction works if necessary. • Instructing the Contractors to examine low noise/vibration construction methods. • Encouragement of idling reduction to the workers. • To avoid works at night and early morning at the sites close to residential areas, schools and hospitals. • Monitoring of noise level at facility boundaries.	Contractor	KPCB/ BWSSB/ Consultant
7	Accident	• Preparation of appropriate construction vehicle operation plan to avoid concentration of machinery and vehicles in limited roads. • Allotment of traffic guide for proper control of traffic in order to minimize disruption to traffic flows. • The construction site should be enclosed with temporary fence to provide a visual barrier between the construction site and adjacent traffic. • Contractor's advance notification to communities in case of blocking traffic for transport of heavy equipment.	Contractor	Police/ BWSSB/ Consultant

18.2.2 Operation Phase – EMP

S. No.	Impacts	Proposed Mitigation Measures	Actor for Mitigation Measures	Regulatory authority
1	Occupational Health and Safety	• Facility design for prevention of leakage of chlorine gas in design.	Contractor	KPCB / BWSSB /

S. No.	Impacts	Proposed Mitigation Measures	Actor for Mitigation Measures	Regulatory authority
	including communication plan	• Containment bunds for all chemical storage area and tanks. • Preparation of plant O&M plan. • Training of O&M workers. • Formulation of procedure to work in confined space. • Monitoring of O2, H2S and CH4 for confined space work. • Preparation of emergency safety plan. • Preparation of emergency action plan. • Protection equipment such as hard hats, earmuffs, safety shoes, and others. • Emergency safety equipments such as Breathing apparatus, reviving apparatus, Vessels containing oxygen or air, Safety harness & ropes and Audio alarms for alerting workers. • Install warning signs whereas the potential dangers are expected.		Consultant
2	Water Pollution	• Preparation of appropriate O &M manual for TTPs. • Regular monitoring of water quality at TTPs and its discharge water bodies.	Contractor	KPCB / BWSSB / Consultant
3	Waste (Screen, Grit, Sludge, Effluent, Lubricant)	• Preparation of manifest system for treatment, transport and final disposal of waste. • Monitoring of manifest of generation, transport and final disposal of waste. • Agreement among relevant authorities such as BWSSB, Contractors and farmers for sludge as manure.	Contractor	KPCB / BWSSB / Consultant
4	Soil Contamination	• Preparation of appropriate maintenance plan of the facilities for prevention of damage. • Early detection of occurrence of leakage of sewage at main sewers. • Visual and odor inspection as regular maintenance. • Quick response to the local residents' information relating to occurrence of odor and detection of leakage of sewage.	BWSSB	KPCB / Consultant

S. No.	Impacts	Proposed Mitigation Measures	Actor for Mitigation Measures	Regulatory authority
5	Noise / Vibration	• Equipment layout/configuration plan at detail design. • Facility design on the materials with high sound absorption and insulation effects. • Monitoring of noise level at the facility boundaries of the TTPs and TSPSs. • Installation of sound proof wall if necessary.	Contractor	KPCB / BWSSB / Consultant
6	Odour	• Facility design for reduction of odour generation. • Monitoring of odor level at the facilities and boundaries of the TTPs and TSPSs sites. • Establishment of handling complaints of the residents and quick response to take measures.	Contractor	KPCB / BWSSB / Consultant
7	Accident	• Safe operation of site. • Preparation of appropriate construction vehicle operation plan to avoid concentration of machinery and vehicles in limited roads. • List of emergency contacts including hospitals and first responders. • Allotment of traffic guide for proper control of traffic in order to minimize disruption to traffic flows. • Sites enclosed with permanent compound wall to protect facilities from site neighborhood. • Contractor's advance notification to communities in case of blocking traffic for transport of heavy equipment and other site wastes.	BWSSB/ Contractor	Police/ BWSSB/ Consultant
8	Climate Change	• Facility design of pump units and blower with high efficiency and inverter type. • Optimum operation of pump in accordance with process flow rate.	Contractor	KPCB / BWSSB / Consultant
9	Infectious Diseases	• Preparation of appropriate working health plan. • Training of working health for workers. • Biannual health camps for workers	Contractor	NACO/ KSAPS/ BWSSB/ Consultant
10	Poverty	• Implementation of public awareness	BWSSB	GoK

S. No.	Impacts	Proposed Mitigation Measures	Actor for Mitigation Measures	Regulatory authority
		programme.		

Abbreviations:

KPCB Karnataka Pollution Control Board

GoK Government of Karnataka

KSAPS Karnataka State Aids Prevention Society

NACO National Aids Control Organization

18.2 Proposed Environmental Monitoring Plan (EMoP)

The Contractor shall carry out the Environmental Monitoring Plan (EMoP) as indicated below.

18.3.1 Construction Phase – EmoP

No.	Item	Location	Parameters	Method	Frequency	Implementing Agency/Responsibility
1	Air Pollution	• Facility boundaries at construction sites.	• Dust. • Particulates.	• Air Quality Meter. • Examination of daily or monthly report.	Monthly	Contractor
2	Waste	• Construction sites for excavation works. • Construction sites for Backfill. • Final disposal site of construction debris.	• Type of construction debris. • Amount of construction debris. • Amount of excavated soil.	• Visual inspection. • Examination of daily or monthly report.	Monthly	Contractor
3	Noise / Vibration	• Facility boundaries at all TSPSs and TTPs facilities.	• Noise level	• Measurement of noise level by decibel meter. • Examination	Monthly	Contractor

No.	Item	Location	Parameters	Method	Frequency	Implementing Agency/Responsibility
		• All sewer network facilities.		of daily or monthly report.		
4	Accident	• Construction sites.	• Safety measures. • Construction practice.	• Visual inspection. • Examination of daily or monthly report.	Monthly	Contractor

18.3.2 Operation Phase – EmoP

No.	Item	Location	Parameters	Method	Frequency	Implementing Agency/Responsibility
1	Water Quality	• At TTPs facilities (Raw sewage, Effluent)	• pH • BOD_5 • COD • TSS • NH4-N • T-N • T-P • Fecal Coliforms	• As per the methods of Indian standards.	Daily	Contractor
2	Waste	• All TSPSs and TTPs facilities as applicable. (Screen, Grit, Sludge, Effluent, Lubricant)	• Location of final disposal site. • Final disposed quantity.	• Examination of daily or monthly report.	Monthly	Contractor
3	Noise / Vibration	• Facility boundaries at all TSPSs and TTPs facilities	• Noise level	• Measurement of noise level by decibel meter	Monthly	Contractor
4	Odour	• Facility boundaries at all TSPSs and TTPs	Odour level of the following chemical substances as odour source:	• Japanese Offensive Odor Control Law (Law No. 91 of	Monthly	Contractor

No.	Item	Location	Parameters	Method	Frequency	Implementing Agency/Responsibility
		facilities	• Ammonia • Methyl mercaptan • Hydrogen sulfide • Methyl sulfide • Styrene	1971, Latest Amendment by Law No. 71 of 1995) or • Prevailing Indian standard		
5	Accident	• All TTP sites and surrounding areas • All TSPS sites and surrounding areas.	• Operation and maintenance practice	• Visual inspection • Examination of daily or monthly report	Monthly	Contractor

18.3 Construction Phase - Environmental Monitoring Forms

18.4.1 Air Quality

Method	Proposed Location	Frequency	Measured Value			
Air Quality Meter	• At construction sites.	Monthly (Examination of daily or monthly report)	Item	Yes	No	Measures Taken (Refer Notes)
			Dust			
			Particulates			
			Vehicle Emissions			
			Other (Specify:)			

Notes:

1. *Sprinkling of surfaces, re-vegetation and delayed stripping of vegetative cover where practical.*
2. *Water stockpiles and storage areas to prevent dust pollution.*
3. *Cover trucks transporting construction materials to minimize spills.*
4. *Shall not overload vehicles.*
5. *Tune and service regularly all construction and transportation vehicle / equipment in order to prevent air pollution.*

18.4.2 Waste

Method	Proposed Location	Frequency	Measured Value	
Visual inspection	• Construction sites for excavation works. • Construction sites for backfill. • Final disposal site of construction debris.	Monthly (Examination of daily or monthly report)	Item	Amount
			Type of construction debris.	
			Mount of construction debris.	
			Amount of excavated soil.	
			Location of final disposal sites of construction debris.	
			Location of final disposal sites of excavated soil.	

18.4.3 Noise / Vibration

Monitoring Item	Measured Value		Standards	Frequency	Measurement Point
	(Mean)	(Max.)			
Noise Level			Indian standard*	Monthly	Facility boundaries at construction sites.
** Indian standard as per Schedule III under the Noise Pollution (Regulation and Control) Rules, 2000 and amendment 2002*					

Area Code	Category of Area	Limits in dB (A)	
		Day time	Night time
A	Industrial	75	70
B	Commercial	65	55
C	Residential	55	45
D	Silence zone	50	40

Notes:

1) *Daytime is reckoned in between 6:00 AM to 10:00 PM.*
2) *Night time is reckoned in between 10:00 PM. to 6:00 AM.*
3) *Silence zone is defined as areas up to 100 meters around such premises as hospitals, educational institutions and courts. The silence zones are to be declared by the Competent Authority. Use of vehicular horns, loudspeakers and bursting of crackers shall be banned in these zones.*
4) *Mixed categories of areas should be declared as one of the four above-mentioned categories by the Competent Authority and the corresponding standards shall apply.*

18.4.4 Accident

Item	Monitoring Place	Monitoring Method	Frequency	Monitoring Result
Adequate safety traffic control manners.	Construction sites	• Visual inspection. • Examination of daily / monthly report.	Monthly (Examination of daily or monthly report)	

18.4 Operation Phase - Environmental Monitoring Forms

18.5.1 Water Quality (Treated Effluent)

S.No	Parameters	Measured Value		Standards*	Frequency	Measurement Point
		(Mean)	(Max.)			
1	pH			6.0 – 8.5	Daily	At all TTPs facilities
2	BOD_5			< 10	Daily	
3	COD			< 50	Daily	
4	TSS			< 10	Daily	
5	T-N			< 10	Daily	
6	T-P			< 1	Daily	
7	Fecal Coliform**			< 100	Daily	
* In mg/L apart from No.7, **MPN/100 mL						

18.5.2 Waste

Monitoring Item	Proposed Location	Frequency	Location of final disposal site.	Final disposed quantity
Screen, Grit, Sludge, Effluent, Lubricant.	• At all TTPs and ISPSs facilities as applicable. • Final disposal site.	Monthly (Examination of daily or monthly report)		

18.5.3 Noise / Vibration

Monitoring Item	Measured Value		Standards	Frequency	Measurement Point
	(Mean)	(Max.)			
Noise Level			Indian standard*	Monthly	At all TTPs and TSPSs facilities
** Indian standard as per Schedule III under the Noise Pollution (Regulation and Control) Rules, 2000 and amendment 2002*					

18.5.4 Offensive Odor

Monitoring Item	Measured Value (Mean)	Measured Value (Max.)	Standards (ppm)	Measurement Point	Frequency
Ammonia			1.0	At all TTPs and TSPSs facilities	Monthly
Methyl mercaptan			0.002		
Hydrogen Sulfide (H_2S)			0.02		
Methyl sulfide			0.01		
Styrene			0.4		

Notes:

1. *Japanese Offensive Odour Control Law, Law No. 91 / 1971 or latest amendment by Law No. 71 / 1995 or Prevailing Indian Standard.*

18.5.5 Air Quality

Monitoring Item	Proposed Location	Frequency	Measured Value			
• Air Quality	• At all TTPs and TSPSs facilities.	Monthly (Examination of daily or monthly report)	Item	Yes	No	Measures Taken (Refer Notes)
			Dust			
			Particulates			
			Vehicle Emissions			

Notes:

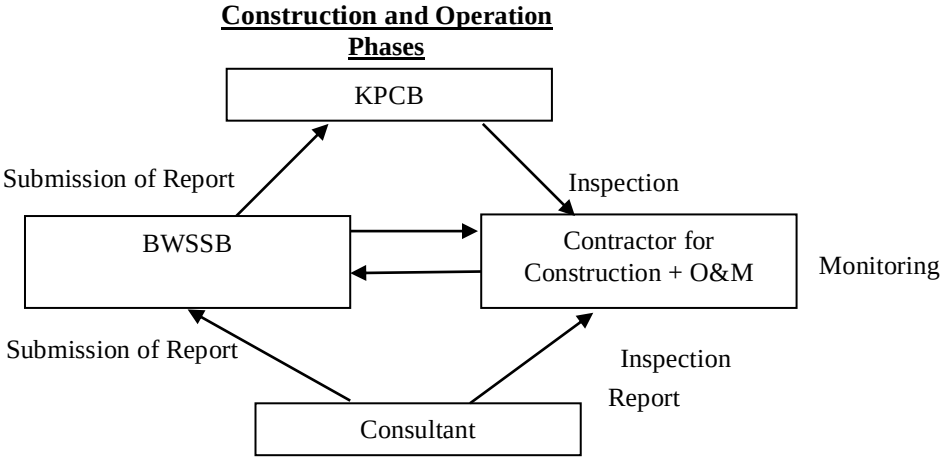
1. *Cover the trucks (or use Bulkers) for transporting waste material (Screen, Grit, Sludge) to minimize spills.*
2. *Shall not overload vehicles.*
3. *Tune and service regularly all transportation vehicles in order to prevent air pollution.*

18.5.6 Accident

Item	Monitoring Place	Monitoring Method	Frequency	Monitoring Result
Adequate safety traffic control manners Safe operation of site	• All TTP sites and surrounding areas • All TSPS sites and surrounding areas	• Visual inspection • Examination of daily / monthly report	Monthly (Examination of daily or monthly report)	

18.5 Implementation Structure for Environmental Monitoring

The implementation structure for the environmental monitoring is shown in the following figure. The main actor of the environmental monitoring will be the Contractor who should undertake each project component of this Contract in the project phases of construction, operation and maintenance. The Consultant and BWSSB will inspect and supervise the Contractor's mitigation measures.



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